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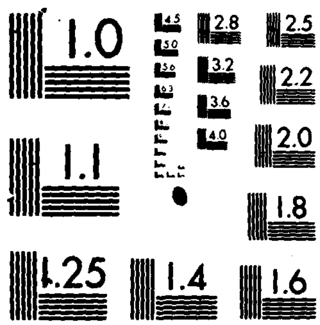
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# TECHNOLOGY AND TAXES


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# Technology & Taxes
## *(A conceptual sketch of reality)*

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The opinions expressed in this paper are those of the author and shall neither be construed as an official position nor as the opinion of the author's past or present associates.

## Abstract

Technology is placed in the clusters of the industrial base and the clusters are defined. The clusters are blended with different sets of economic condition and the preservation of earning power established as the objective function for any investment. The link between the clusters, the environment and the objective function is established through taxes and the tax impact on depreciation time and replacement value is analyzed. This analysis is used to discuss the decision process for industrial-technological investment. The observations made in the analysis are summarized and suggestions are made on how to respond to reality.



## Acknowledgment

This paper is based on my lecture notes from MIT, VPI&SU, from DSMC lectures, previous papers and my draft for my forthcoming book on Technocratic Economy. However, the spark to apply this material come from Major General William E. Thurman, the present project manager of the B-1 project and former commandant of the Defense Systems Management College, Fort Belvoir. RAdm. (Ret.) E. Otth and RAdm. J. Sansone from NAVSEA and NAVMAT encouraged my private work and Dr. Varly, ONR, and other members of the former acquisition research counsel acted as a critical sounding board for many of my ideas. To all above and many unnamed goes my "thank you." I am willing to share the glory with them, however the responsibility must remain my own.

F. A. P. Frisch

[illegible] 1982

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*Man keeps looking for*
*a truth that fits his reality.*
*Given our reality,*
*the truth doesn't fit.*
*Aphorisms* – W. Erhard

## Objectives

The first objective of this paper is to explain how a specific tax structure and PROFIT DEFINITION, can operate as incentive or disincentive toward investment in manufacturing technology. The second objective is to explain why the same tax structure and profit definition produces different impacts on different companies and under different economic conditions.

## Scope

The scope of this paper is restricted to a few selected RUDIMENTARY CONCEPTS, able to make or to break the potential success of innovations in manufacturing technology. All concepts are presented in a rudely simplified and linearized form; the concepts are not tools for calculation, but models designed to enhance the understanding of reality. Accordingly, only conceptual results are offered and no subjective value judgments are made. The entire presentation is made in a non-mathematical form.

## Approach

The paper is subdivided into two parts (with five chapters) and delineated as shown in *fig. 1:*

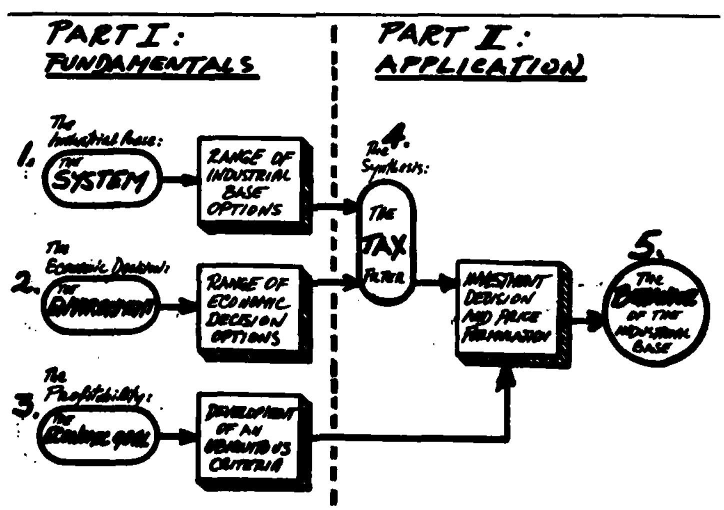



**Fig. 1** Approach

*PART I* deals with the fundamentals and tries to define and describe (1) the system, where the technology of manufacturing is embedded; (2) the environment (in economic terms) which influences the system and, finally, (3) the economic goal which must be the basis for any enterprise.

*Chapter 1* explains and defines the Industrial Base and shows that the base is not a uniform homogeneous entity, but a collection of diversified and pluralistic elements with a wide range of behaviour patterns. Each element can be considered in itself stable but different from all other elements.

*Chapter 2* describes the permanent changing environment, where each element is in constant flux and where the relationship between the elements is constantly changing. This chapter will explain the conditional value of all business decisions and, in turn, why today's correct decision might well be the wrong one tomorrow.

*Chapter 3* searches for a neutral line between profit and loss in order to extract the two concepts (of profit and loss) from our belief system and to shift them into the analytical arena, by developing a ubiquitous criteria for these two concepts.

*PART II* uses the results of PART I and attempts to develop a synthesis between the system and the environment by channeling both the system's elements and the environment's elements through a tax-filter toward the investment decision and the price formulation. The result of this synthesis will be the determination of the unavoidable investment behaviour of the defense industry.

*Chapter 4* is dedicated to an analysis of the U.S. tax concept as it relates to depreciation time and replacement cost for capital investment. The impact of the profit cap (as frequently applied in defense contracts) is related to the return on investment and to the economic goal (Chapter 3).

*Chapter 5* finally relates the analyses of Chapter 4 to the managerial decision process regarding investment in technology and the often observed decision behaviour connected to the causes for such behaviour.

The paper closes with a section on General Observations and Suggestions. This section stands for what normally would be called findings and recommendations. However, the paper covers only a small part of a much wider picture and hence the term "recommendations" would be too presumptuous.

# ORIENTATION

*Many disciplines are involved in investment decisions for technology, such as engineering, economics and law. And each exists in its own world.*

## 1. Communication

The trend toward low investment for defense contracts has been widely recognized and some of the causes for this trend have been identified[1]. However, this identification has (to my knowledge) never proceeded beyond editorial statements bare of conceptualization and hence quantification in its entirety. Only a few selected causative aspects have been quantified[2] and some hesitant steps have been made to conceptualize the problem in part[3]. Hence the practitioners of acquisition—in industry and government—have considerable difficulties to communicate with the lawmakers beyond the level of lobbying for the perceived needs of the industry. And as long as this communication gap persists, the industry—and in turn the government contractors—will never get this particular legal environment which is the foundation for a flourishing industry, including a healthy defense industry.

All of us in the acquisition business, in and outside of the government, have failed to do our homework: We have never quantified to the lawmakers just how much the legal disincentives for investment (which, we pronounce, exist) really cost us on the company level or as a nation. We are only complaining that they exist. How then can we engineers and economists expect to be taken seriously by the lawmakers when we are not even able to quantify our complaints?

What sense does it make to feel intimidated by the laws (pertaining to acquisition), laws which we make ourselves through our representatives? But instead of reaching an agreement, we set out to minimize, to bypass and to compensate for the legal disincentives by payment provisions and contract incentives like termination provisions, award fees, shared saving provisions and technology funding. Of course, those actions are better than none, but they are not a cure for the problem of "not investing."

I think it is overdue to stop lobbying and complaining and to break out of the vicious circle to shift the blame around for the predicament of our industry and, more specifically, for the present predicament of the industrial base. So let's forget all our rhetoric, our beliefs and preconceived opinions and let's start with our analysis of facts which exist *today*—without being concerned with how they come into being. Those facts can support, in themselves, a consistent and testable theory or concept[4]. Such analyses could be the start toward the creation of a legal environment which permits and supports the conscious rebuilding of our industrial base, the health of which is in everybody's mind. The tragedy is that we are not held down by physical barriers, but by our mental barriers concerned with existing paradigms borrowed from the past[5]. Maybe Secretary Lehman's closing words of his last address may give us the

guts to overcome those barriers. Speaking about the rebuilding of the Navy he said, "It might be our last chance."[6]

Now, I will stop my own rhetoric and introduce you to an analysis which will justify what I said until now. The analysis which I bring forth in this paper is only a sketch, a condensation and a cross-section of a very small part of an analysis which I pursued for years[7]. When I unfold the analysis you will see into an exciting world of "integrated reality" where engineering, economy and law work together and can communicate across disciplinary boundaries. Unfortunately, this reality might not conform to what you *think* the truth is.

## 2. Legenomy

Not only was I always fascinated with what I called above the "integrated reality," I also was privileged to experience it in my professional life and foremost to teach it[8]. In order to highlight the integrated reality I coined years ago my pet acronym, *legenomy*[9], which implied the inseparable interaction of *leg*al aspects with *en*gineering aspects and aspects of econ*omy*.

We find this inseparability of aspects in all human activities and especially pronounced in all industrial activities: "We are conducting all industrial activities within the framework of the existing law and we are using all appropriate engineering know-how in order to reach an economic (or political) goal – either as a society or as an individuum." Without the law we would have anarchy; without the engineering know-how we could not have our modern industries, and hence our economic goals could not be what they are. It remains only to question if the three aspects of law, engineering and economy have in their intellectual perception progrossed simultaneously or if one might have outrun the others, leading to organic incompatibilities, to stress and ultimately to confusion[10]. In order to achieve true success, all three aspects of legenomy must march together in an ever-changing mode and form together the total picture with all their interacting links as sketched in the interface matrix in *fig. 2:*

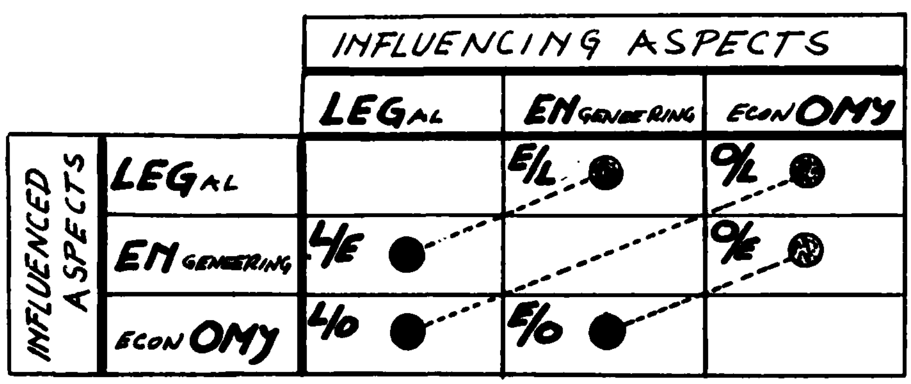



**Fig. 2** Legenomy Matrix

The interface matrix is, of course, symmetrical, indicating the double direction of all interfaces and this direction changes back and forth over time, forming the historical path toward this "what-is" today. And with this I will concern myself. More specifically, I will search for an explanation of the behaviour of the defence industry as it appears today in the USA as the result of existing laws, the manufacturing technology used, and the applied economic scales. Let's call this the general goal of this paper.

This general goal, however, is too broad to be pursued with any resemblance to completeness in a short paper. Hence I will select in each of the three categories of aspects (law, engineering and economy) a few specific elements which I consider as representative for each category as shown in *table I:*

| *CATEGORY* | *ELEMENTS* |
|---|---|
| *Legal* Aspects | —Depreciation Rules<br>—Permissible Profit<br>—Admissible Cost |
| *Engineering* Aspects | —Manufacturing Methods<br>—Labor versus Capital Intensiveness |
| *Economic* Aspects | —Investment & Investment Criteria<br>—Return on Investment<br>—Replacement Cost & Inflation<br>—Necessary Profit<br>—End Cost |

**Table I** Representative Elements

I consider these selected representative elements as the absolute minimum to be analyzed in order to get at least some coherent picture about the investment behaviour of the American defence industry. In turn, the existing behaviour can be equated to the necessary management decisions as *de facto* made in the industry.

# PART I

## FUNDAMENTALS

*The surest way to lose any popularity contest is to ask for the definition of terms. Forced to develop such definitions, one might find out that reality differs from rhetoric.*

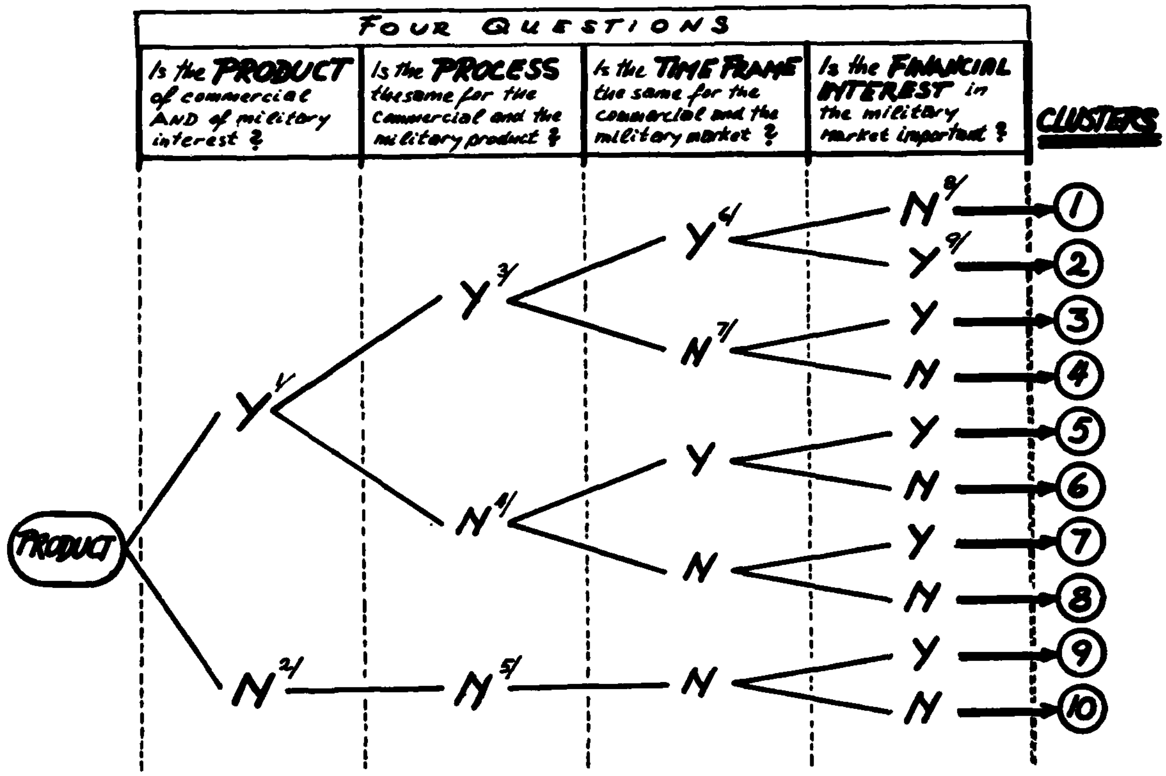
### 1 THE SYSTEM: The Industrial Base

The industrial base – all shipyards, the supply industry, subcontractors, etc., are all parts of it. Therefore, we can *define* the industrial base as the sum of all industries which provide goods and services to the armed forces[11]. The base, however, is *not* uniform, but consists of a wide spectrum of many heterogeneous members. On the one side of the spectrum the base might include the company who works for defense only (like some shipyards) and on the other end of the spectrum might be the company who sells one of its shelf items to the government only on occasion.

Although each member of the industrial base is different from all other members, it will still be possible to cluster the participating companies into groups with strong similarities. In turn, it might be possible to deal with all members in a specific cluster in a fairly uniform way. I suggest to subdivide the entire spectrum of the industrial base into ten clusters and describe each cluster with four criteria[12]: (1) the type of product, (2) the process or technology used to make the product, (3) the time frame (or duration) for which this product will remain in production or stay on the market, and (4) the financial interests which a company has in making such a product. Thereafter I ask one question with regard to each criterion to be answered with YES or NO. This leads to a criteria-tree with 16 end branches. However, only 10 of those 16 branches are meaningful. This is demonstrated in *fig. 3*.
With the relatively simple criteria-tree we have a handy tool to describe ten industrial clusters in a non-ambiguous way (of course, the tree can be extended to satisfy any analytical need). For example, Cluster #1 describes a product useful for the military and civilian market, made in the same process for the same duration of time, but the manufacturer has no particular interest in the military market segment. Cluster #10 would be an exclusively military product, made in special facilities according to the life of the military market, but the product is without financial interest to any manufacturer.

The product of Cluster #10 would be a perfect candidate for an arsenal operation – and this might be the only way to get the product in the first place. Products belonging to Cluster #1, on the other hand, will be a typical commercial product and supplied to the market on a strictly competitive basis, irrespective of its origin, i.e., it might be made in and imported

from Hong Kong. And this brings us to two other criteria not mentioned yet: There exist military products which *must* be manufactured domestically for security reasons irrespective of costs and possible competitive advantages of foreign sources. Industries catering to this type of product are defined as political industries, while producers of items which can be made domestically or abroad shall be candidates for the common industries which operate on financial principles only.




**NOTES:**

[1] The product will be of military and commercial interest.

[2] The product will be of military interest only.

[3] The produc .. be manufactured with the same process for civilian and military customers.

[4] The product goes to the military and the civilian market but two different processes are used because of special quality standards for the two markets.

[5] The military product requires a process not used for commercial markets (i.e., tank turrets).

[6] The life of both markets has the same length (i.e., 3 years in production).

[7] The market time for both productions will be different (i.e., the commercial product will change after two years, however the military usage will extend over ten years.

[8] The manufacturer has *no* financial interest in the military market.

[9] The manufacturer has financial interests in the commercial *and* the military market.

**Fig. 3** Criteria Tree

A strong relationship can be established between military industries (Cluster #10) and political industries. An equally strong relationship can be established between commercial industries (Cluster #1) and common industries[13]. This permits us to limit the *range* of the industrial base with four non-ambiguous borderlines as shown in *fig. 4a:* (1) the commercial industries, (2) the military industries, (3) the common industries and (4) the political industries. In this entire field, only the points *A* and *B*, approximating Cluster #10 and Cluster #1 are non-ambiguous. All other points inside the range (represented by Clusters #2 through #9) are *mixed* industries with increasing density toward point *B* and decreasing toward point *A* as shown in the cluster diagram in *fig. 4b.* An analysis indicates[14] a normal distribution between point *A* and point *B*, representing the industries' inclination to invest as a function of their location within the range: Industries of a clearly commercial/common type *might* have the inclination to invest, but industries of a clearly military/political type *will not* have any inclination to invest. The inclination to invest is shown in *fig. 4c*, indicating an increase in inclination to invest in the direction of *B* and a decreasing inclination to invest toward point *A*.

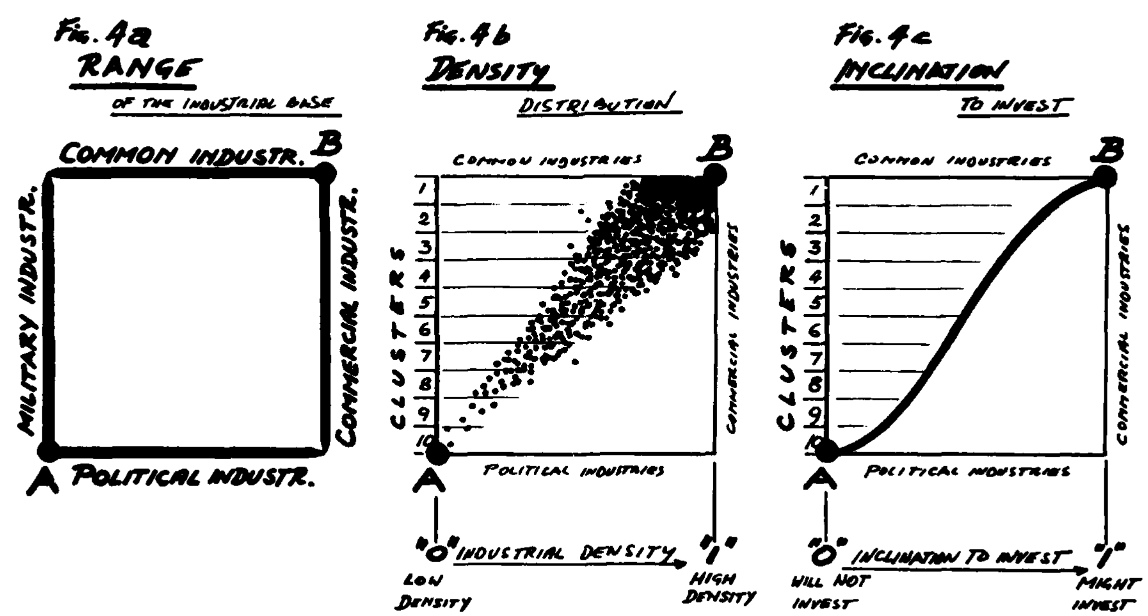



**Fig. 4** Spectrum of the Industrial Base

I have underscored the "might invest" in order to indicate that the placement of a particular cluster (or individual industry) is only a necessary condition toward investment, but not in itself a sufficient condition. Whether this "might " will be transformed into a "will invest" depends upon the environment and other conditions to be sketched in the next chapters.

## 2 THE ENVIRONMENT: Economic Determinants

No question: technology can reduce labor cost and will increase labor productivity. This is a simple truth, but not a sufficient argument for an investor to spend money on technological improvements. Even assuming that a healthy market exists – the *sine qua non* for any industrial investment – the following environmental factors will enter (next to many other factors) into any investment decision: (1) the Availability of Labor (AL), (2) the Cost of Labor (CL), (3) the Cost of Capital (CC), and (4) the Competitive Return on Investment (CRI).

None of these four factors are a constant; each will change in time and at different times, and so will the ratios between the factors. Hence today's correct decision might be – with changed values of the factors – the wrong decision tomorrow. I will explain this in *tables II, III* and *IV*. In *table II*, I combine the availability of labor with the cost of labor; in *table III*, I combine the cost of labor with the cost of capital, and finally in *table IV*, I combine the cost of capital with the competitive return on investment. For each factor-set I use four combinations: (1) high-high, (2) high-low, (3) low-high and (4) low-low. With this I cover the entire trade-off spectrum (for investment in technology) on a one-to-one basis for the key combinations in *tables II, III* and *IV*. The key combinations will permit one to formulate the logic for all other possible combinations, including multiple factor combinations, as shown in the determinator-tree in *fig. 5*. In reality, all factors are mutually related; this makes the problem of investment complex, despite that each factor in itself is simple. (Complexity in this context is defined as *the existence of multiple, often divergent, objectives.*)

| # | *(AL)* | *(CL)* | *Investment Consequences* |
|---|---|---|---|
| 1 | high | high | Neutral. Investment decision will depend upon views toward the future[1]. |
| 2 | high | low | Clear *disincentive* for investment[2]. |
| 3 | low | high | Clear *incentive* to invest in technology[3]. |
| 4 | low | low | Neutral to investment[4]. |

[1] This is essentially an unnatural condition. High labor availability and high labor cost at the same time occur only because of institutional barriers against an adjustment between supply and demand.

[2] No one will invest if labor is plenty and labor cost low—as long as the job can be done.

[3] This is the ideal condition for investment.

[4] This situation is as unnatural as the high/high combination above. However, such condition might be a mobilization scenario—making investment in technology mandatory because of labor shortage—but not for economic reasons.

**Table II** Availability of Labor (AL) and Cost of Labor (CL)

| # | (CL) | (CC) | *Investment Consequence* |
|---|---|---|---|
| 1 | high | high | Neutral to investment[1]. |
| 2 | high | low | *Highest* possible investment *incentive.* |
| 3 | low | high | Absolute *disincentive* for investment[2]. |
| 4 | low | low | Neutral to investment[1]. |

[1] If both, (CL) and (CC) are high or both are low, the investment decision is driven by many considerations.

[2] Investment will be kept to the absolute minimum as necessary to execute the manufacturing job.

**Table III** Cost of Labor (CL) and Cost of Capital (CC)

Before I go to the next table, I have to explain the term of Competitive Return on Investment (CRI). In the context of the present notes I *define* (CRI) as the after-tax return on investment, whereby the investment is *not* made in manufacturing, but in other more profitable and less risky investment opportunities – for example, in money markets or in condominiums.

| # | (CC) | (CRI) | *Investment Consequence* |
|---|---|---|---|
| 1 | high | high | No investment in production[1]. |
| 2 | high | low | No investment anywhere[2]. |
| 3 | low | high | Marginal investment incentive[3]. |
| 4 | low | low | High incentive to invest in production[4]. |

[1] High (CC) and high (CRI) go for institutional reasons hand in hand. Since the (CRI) has normally less risk than production (or investment in manufacturing technology), the investment moves to nonproduction-oriented endeavors.

[2] This situation is purely hypothetical.

[3] Not much more realistic than case 2 before.

[4] The ideal condition for investment in production technology.

**Table IV** Cost of Capital (CC) and Competitive Return on Investment (CRI)

If we inspect *tables II, III* and *IV*, we will notice that only one simple, clear and non-ambiguous set of conditions exists which will provide an incentive – within the market opportunity – to invest in manufacturing technology. This set contains (1) a low availability of labor, (2) a high cost of labor, (3) low capital cost and (4) lack of other more attractive investment opportunities. Only and *only if* those four conditions – plus a market – exist, will in-

vestors invest "without reservation" in manufacturing, and hence productivity will increase appropriately. Next to this ideal set (I) of conditions, nine other valid sets can be determined as shown in *fig. 5:*

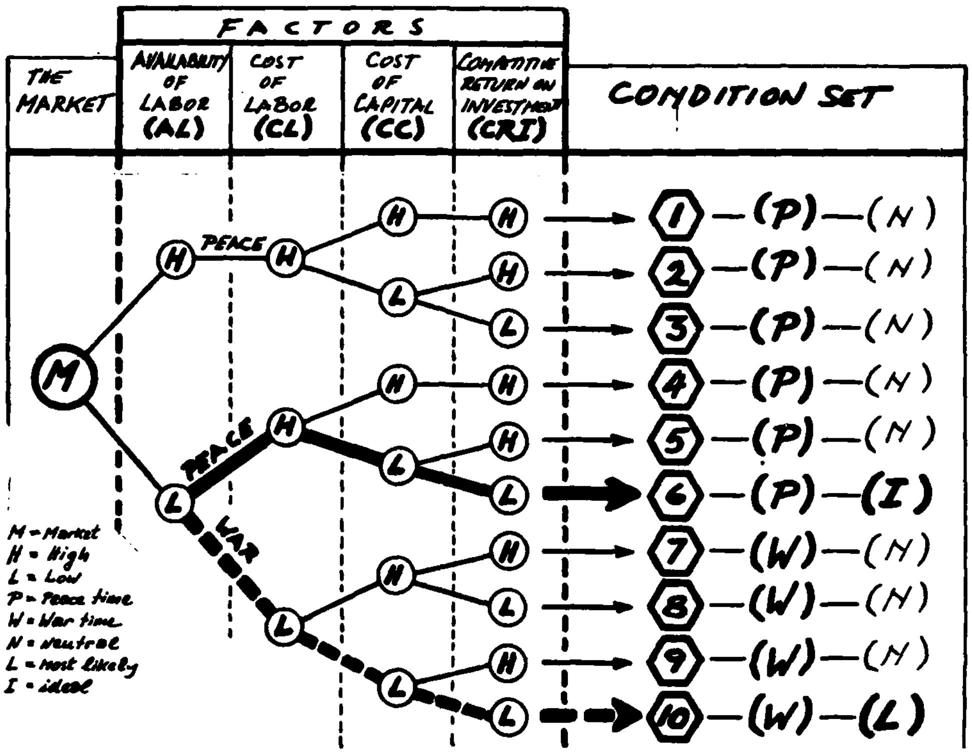



**Fig. 5** Condition Tree

From the total of 10 sets of economic conditions, two groups evolve: the first six sets valid for peacetime conditions (P), and one of these sets as the ideal set (I); the second four sets valid for wartime conditions (W) with one most likely set (L). This means that only sets #6 and #10 are reflecting clear and non-ambiguous conditions for investment in technology, while the remaining eight sets are either neutral (N) to investment or of such nature that investment decisions will be made outside the identified set. I prefer to call those eight sets "undetermined."

It is important to note that the condition for investment can clearly be separated in peacetime and wartime conditions; in both cases, however, the question must be raised about the possibility of shifting the undetermined cases into a positive position for investment. We will find that an appropriate tax structure has this shifting power—with the result that a wide range of condition sets might be able to produce a "profit"—the only motivator for private industry investment.

## 3 THE ECONOMIC GOAL: Profit

Profit is the flywheel of a free economy and of the capitalist system. Profit equates to growth. Hence one could assume that in a free society everyone appreciates profit and, of course, everybody knows exactly what profit is and how to define it. Unfortunately, these assumptions are wrong: Any discussion of profit brings out a plethora of contradictory and uncoordinated feels—from admiration to condemnation. We are still replaying all philosophical and moralising disputes from Aristotles' time and presumably even before him[15] up to modernity[16]. With regard to a definition of profit, we are faced with a surprise: We have no definition—at least no ubiquitous analytical definition of profit. Nevertheless, our army of tax accountants calculates with great precision our profits according to the legislative definition of the day. And this is it—where the trouble starts—because in today's environment, where rapid inflation makes a mockery of conventional accounting, where for more than a century companies have calculated their profits and losses on the basis of historical cost[17]. Contemporary attempts to search for a guaranteed purchasing power[18] by indexing depreciation, shifting to a system based on the replacement cost, immediate expensing[19] and full current cost accounting, are all in essence a search to define profit in a way acceptable to business and, in particular, to industry, as well as to investors in general.

Profit is an extremely elusive concept which may well defy a universal definition altogether. Using an analogy from *General Systems Theory*[20], zero-profit (or zero-loss) might be the borderline between the entropy of the system and the metabolism of the environment[21]. With this analogy we by-passing the definition of profit and shift the search for the definition toward the search for a condition, which guarantees an economic *status quo* in perpetuation. I associate this *status quo* condition, or condition of economic stability, with the PRESERVATION OF EARNING POWER[22] and I stipulate any economic operation which guarantees this earning power as free of loss and profit; any operation which results in an increase of earning power shall be associated with profit and any operation which reduces the earning power shall be associated with a loss.

The concept of the PRESERVATION OF EARNING POWER is an extreme abstraction which cuts across all problems related to a specific *numéraire* of a currency, to problems of inflation and depreciation. The concept can embrace all previously mentioned attempts at incentive taxes and may even open the door for the conjecture of the existence of a biological foundation of economy[23] as we have discovered the biological foundations for many other human behaviours[24] and even for the human value systems[25]. From a practical point of view, the concept of the PRESERVATION OF EARNING POWER can consolidate the needs of investment in production, in services and in rent with depleting values of the source of earning power. With this, even the need for an ideological context (of profit) can be eliminated and the discussion be shifted into the politically neutral analytical arena.

Two examples might illustrate the concept of PRESERVATION OF EARNING POWER. First, a most homely example of a truck-owner-operator and second, an example of ocean transportation[26].

**Example #1:** Let's assume a trucker buys at time zero a 20-ton truck for cash and the truck will have a lifetime of three years. Now, he starts to operate his truck industriously and intelligently and also saves money in order to replace his truck with a new one after three years. If he is then able to replace it with a new one (and only by using his own savings), then we may say that he was able to preserve his earning power. However, if he is only able to buy a 10-ton truck with his own savings after three years, then he lost half of his earning power. Whether this loss has occurred because of inflation, because of tax laws which prevent accumulation of sufficient means for full replacement, or because of competitive pressure (which prevents billing his clients for his cost "in full") is irrelevant. On a variation of this example, let us assume that our honourable trucker decides after one year to give up the trucking business and he sells his truck. If at this time the resale value of his truck plus the saved money *would* enable him to again buy a 20-ton truck, we may again say that he preserved his earning power. If he *could*, however, buy only an 18-ton truck, he lost 10% of his earning power. Again the reasons for his loss are irrelevant.

**Example #2:** This historical example compares the new building cost index for a commercial ship over a 15-year period with the resale value index for the same ship purchased in 1945, shortly after the end of World War II. This is shown in *fig. 6:*

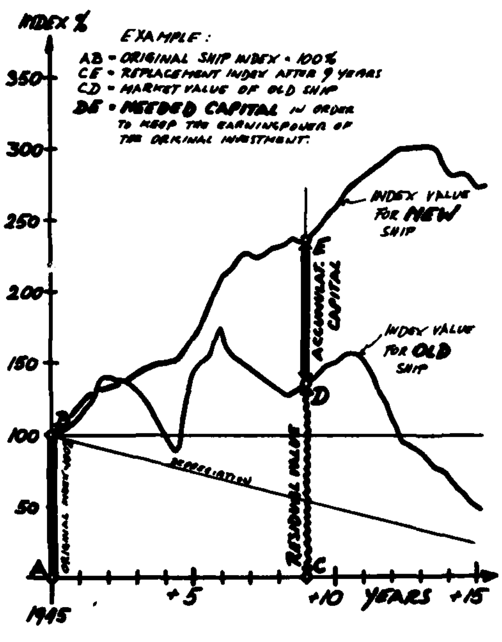



**Fig. 6 Ship Index 1945-60**

*The two examples enable us to phrase the rules* for the preservation of earning power in the following way: "The earning power of any tool, representing such earning power can only be preserved if, at any time in the life of such a tool, the disposal amount thereof, plus the accumulated capital, permits the replacement of the tool of earning in full." If this rule cannot be met, a loss of earning power occurs—and only if the original earning power can be increased in these transactions, does a profit occur.

In turn, this rule permits us to define valid competition as this competitive condition which permits a price formulation according to the rules of the PRESERVATION OF EARNING POWER. Competition, or pressure of competition, which does not permit achievement of this rule is "invalid competition," and must lead to the destruction of the involved industry[27]. Large parts of our national industrial base and, last but not least, the shipyards, are a perfect example of self-destruction through invalid competition—with the later explained result, why those industries cannot and do not invest in technology beyond the absolute necessary minimum.

# PART II
## APPLICATION

*All scientific laws emerged from a theory. A theory is a logic construct, modeling reality based on a few observations. If thereafter the theory can be verified without exceptions, then the theory will gain the power of a law.*

### 4 THE SYNTHESIS: The Tax-Filter

Let us start the synthesis with a summary of what we have determined in the first three chapters: *first*, we determined that the industrial base is composed of ten different clusters, where each cluster has its distinct characteristic. Only one one of the clusters (namely the common/commercial Cluster #1) has a definite inclination for probable investment in technology, and only one cluster (the military/political Cluster #10) has a definite resistance or disinclination for investment. *Second*, we determined that only one single set of environmental conditions exist, which favours investment in peacetime and one in wartime, while five, respectively three sets are neutral to investment in peace or war. *Third*, we have determined that the preservation of earning power is the unalterable goal of any economic operation and profit is associated with income beyond the need for stability.

In the search for a synthesis of the first two chapters, we can combine the criteria-tree (*fig.* 3) with the condition-tree (*fig.* 5) and determine thereafter the profit potential of one hundred end-branches. This profit potential (or profit) provides us with the inputs for the investment decision through the feedback loop into the "process." If we recognize now that the "profit" is surrounded by taxes, then we may state that the after-tax profit will determine the *de facto* investment. The combinations and the feedback loop are shown in *fig. 7:*

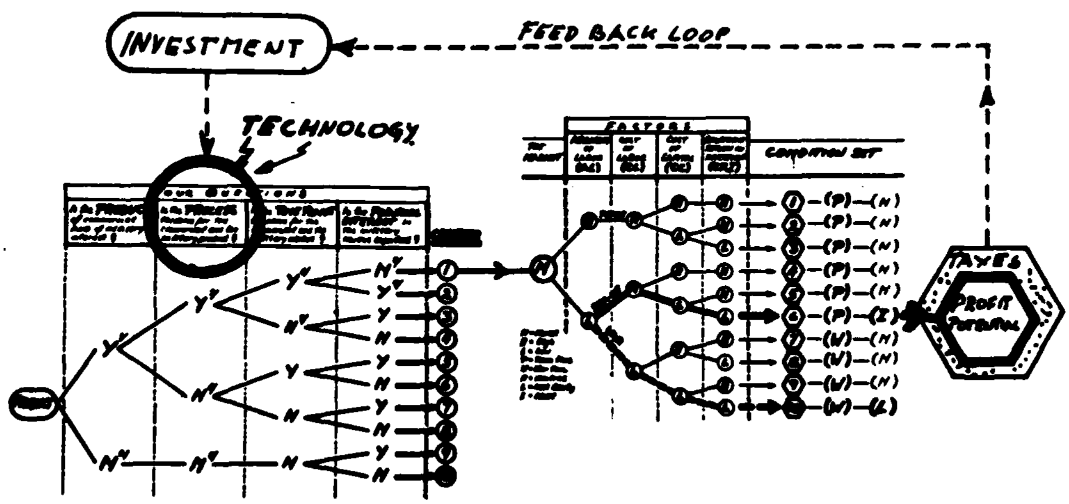



**Fig. 7** Combined Criteria/Condition Tree

For a quantitative analysis the schematic of *fig. 7* can be computerized as sketched in the block diagram in *fig. 8*. The schematic describes an iterative search process with a feedback loop into the market based upon an increased productivity; the schematic also shows the options to accommodate changed environment conditions and changes in the tax law.

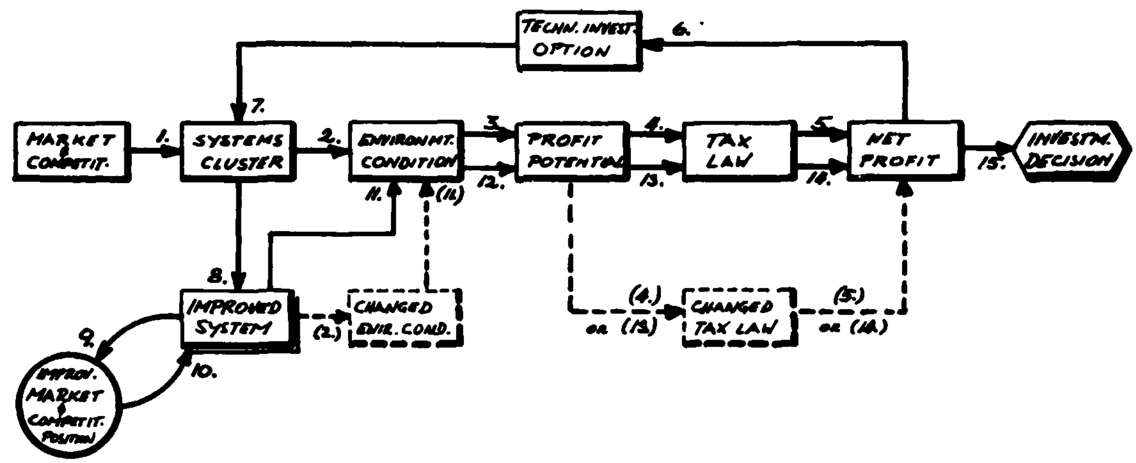



**Fig. 8** Iterative Computation Schemata

The investment decision of the computation schematic can be interpreted as a search for the compatibility between what an investor (in technology) can get under the present legal-economic setting and of what he needs to preserve the earning power of his investment: If, and only if, compatibility exists, he will invest; if this compatibility does not exist, he will not invest. This compatibility situation is sketched in *fig. 9*. Conceptually, the compatibility search is the unifier of the entire problem discussed[28].

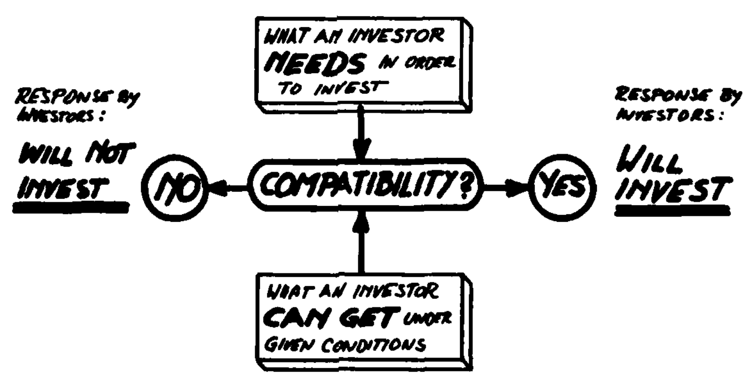



**Fig. 9** Compatibility for Investment

The iterative computation schematic (*fig. 8*) implies the position of the taxes as the coordinator between the constant systems cluster and the variable conditions of the environment. In this position, taxes are able to transform a neutral investment condition into a favourable one, or they can destroy all hope for investment even though inclination for investment might exist. Taxes can rescue a bad situation and can kill a good one. *De facto* taxes are cutting through all ideological rhetoric and dogmatic smokescreens and reveal the true thinking and attitudes of a nation toward business[29] like the driving habits reveal the true character of man. Taxes reveal a nation's priorities, ideosyncrasies, aspirations, beliefs and superstitions in a most brutal way[30], especially if portrayed in a comparative way for selected and highly specialised tax aspects[31]. Hence, it seems to be justified to consider taxes as the centerpiece in any investment decision searching for growth and, in our particular case, increase in industrial productivity. In short, taxes *are* the synthesis of the problem as sketched in *fig. 10:*

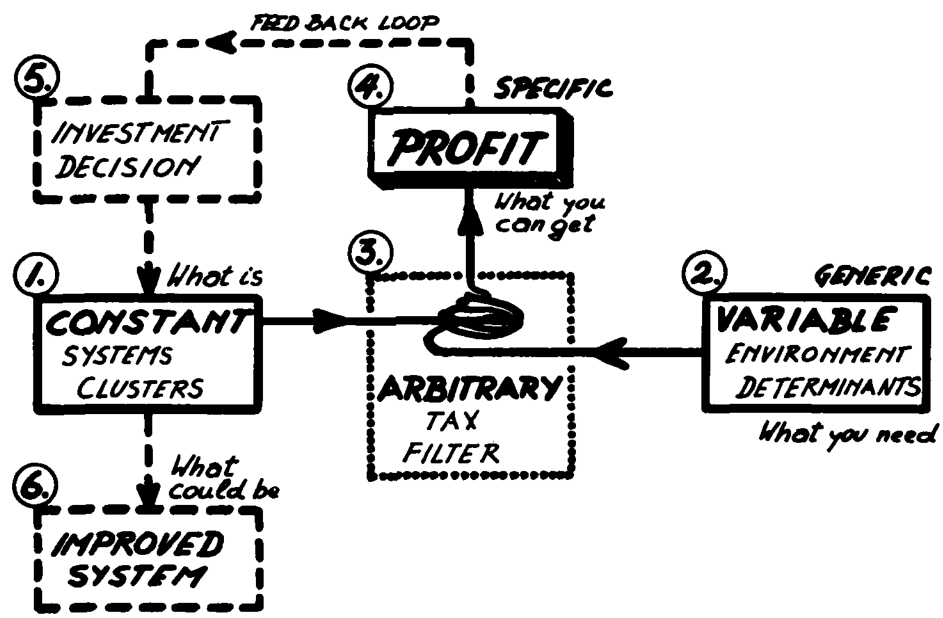



**Fig. 10** Synthesis of Problem

The complexity of the investment decision is underscored by the unique combination of (a) a *stable* system, (b) a *variable* economic set, and (c) an *arbitrary* tax filter, which synthesises the problem (*fig. 10*). The encouraging aspects in this synthesis is the arbitrariness of the tax filter, because whatever is set up arbitrarily can also be changed if necessary. With arbitrariness I do not imply that the existing tax filter has been constructed by happenstance but rather by applying uniformly a specific tax philosophy uniformly to a non-uniform industrial world, whereby non-uniform means "being not the same in *all* aspects."

In order to illustrate the non-uniformity with regard to the tax impact between the civilian and military worlds, I have selected first the problems of depreciation time and second the problem of replacement cost for discussion. Both problems will be sketched in their conceptual forms, but otherwise simplified and linearised.

## Depreciation Time

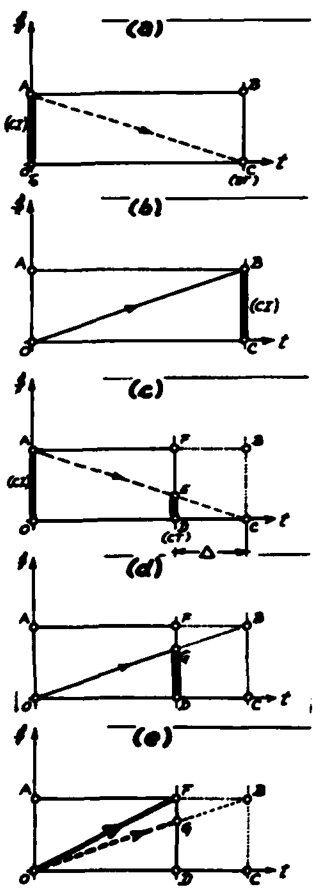
The depreciation time is determined in the United States uniformly for all economic activities by the tax laws for a few categories of facility investment. Presently we recognise three categories of facility investment while already over 50 years ago studies on less sophisticated technologies (than today) have identified over sixty prevailing replacement patterns and therefore depreciation needs in the industry[32].

The state purpose of depreciation is to recuperate tax-free the invested capital (IC) in the depreciation time (DT). The non-stated assumption (in departure from reality) behind this tax rule is first that the investment in equipment has a useful life (UL) which is exactly as long as the depreciation time (DT) and second, that said investment has at any time during its lifetime (LT) a market value (MV) equal to the remaining non-depreciated amount (ND). This assumption is commonly used as basis for commercial investments and might be valid for companies belonging to Cluster #1 – the commercial/common industries. However, neither of these two (never clearly stated assumptions) holds through in defence acquisition, where quite frequently first the contract time (CT) is shorter than the depreciation time (DT) and second, where uncertainties in the contract history might not permit utilisation of equipment for its entire useful life (UL) and where said investment has no market value (MV) whatsoever.

The differences between investment in commercial and military products lie in "assigned investment" and not in "dedicated investment" like jigs and fixtures made and purchased in pursuance of a specific contract where cost allocation for a single contract is permitted in full. Assigned investment is defined as an investment (i.e., in manufacturing technology) which enhances productivity in a plant or a shipyard beyond the duration of a specific government contract, made (or initiated, or encouraged) only in the context of a specific government contract, and which would not have been made without the existence of such contract at hand. Assigned investment might be triggered by a specific government contract, but is in itself the crucial contributor to industrial improvement and, therefore, the problem of assigned investment needs discussion. The problem is imbedded in the following five assumptions: *first*, a company invests capital (IC) in manufacturing technology in order to increase the productivity for a specific contract in the hope of increasing its competitive position; *second*, the new equipment is assigned investment or invested capital (IC) of such nature that the equipment cost *cannot* be allocated in full to a specific contract – only the normal depreciation costs are allowable costs; *third*, the contract time (CT) is shorter than the depreciation time (DT); *fourth*, the investment (IC) has no market value at the end of the contract time (IC) or at any time before, meaning it cannot be sold to somebody else like a used car, and *fifth*, absolute

uncertainty exists about the possibility of a follow-up contract which would enable the utilisation of the investment (IC) for the entire depreciation time (DT).

The five assumptions can be connected through a set of often overlapping events (observations, actions, reactions, etc.) as sketched in their rudimentary forms in the picture series of *fig. 11.* The picture series starts with the elementary explanation of depreciation time[33] and ends up with the newly developed term of SIMULATED INVESTMENT (SI)[34] and, more specifically, with the simulated investment needed to cover the penalties resulting from a contract time (CT) being shorter than the depreciation time (DT) in a given defence contract. The simulated investment (SI) is *defined* as (or describes) this particular imaginary investment level toward a company having to accumulate capital in the contract time (CT) in order to carry all penalties resulting from the time differences as described above without losing the earning power of its investment.



The entire problem plays in the coordinates formed by the Time-Axis ($t$) and the Cost-Axis ($). At the time $T_0$ (point 0) an assigned investment (see text for definition) or, generally speaking, a capital investment (*CI*) is made. The amount of this investment goes from point 0 to point A. The value of this investment is depreciated along the arrowed broken line from point A to point C at the end of the depreciation time (*DT*) at point C. There the investment is finally depreciated to zero. (Linear depreciation is used and the scrap value at the end of the depreciation time is neglected.)

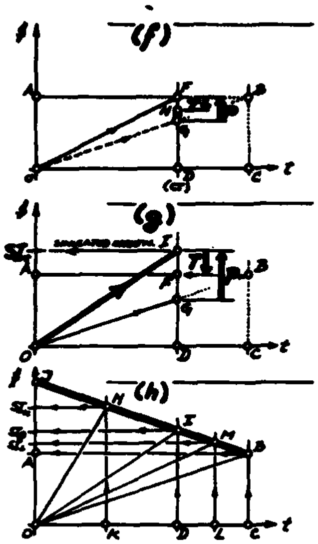
At the same time, when depreciation takes place (*fig. 11a*), capital can be accumulated tax-free from point 0 toward point B along the arrowed full line and at the end of the depreciation time (*DT*), the entire capital (*CI*) is recuperated. The amount of the recuperated capital goes from point C to point B and is, of course, the same as the amount between point 0 and point A.

In this figure we introduce the contract time (*CT*). The contract time stretches from point 0 to point D, while the depreciation time stretches from point 0 to point C. The figure shows a contract time (*CT*) shorter than the depreciation time (*DT*) by the amount Δ. For the investor of assigned investment, the picture is only of interest from the time $T_0$ at point 0 to the contract time (*CT*) at point D; the pat of the picture right of the line from point D to point F goes into oblivion. We notice that at the time (*CT*), the capital investment between point D and point E is not yet depreciated. Of course, the depreciation goes along the arrowed broken line from point A to point E and the continuation of this line to point C is no longer of interest.

The investor not only loses interest in the depreciation beyond the contract time (*CT*), he loses interest also on the imagined capital recovery after this time. But he notices that at the time (*CT*) he has only recuperated capital in the amount from point D to point G along the arrowed full line from point 0 to point G.

Since the investor expects no contracts with any reasonable certainty beyond the contract time (*CT*), he should have recuperated his investment (*CI*) in full in the contract time (*CT*) along the arrowed broken line from point 0 to point F (or along the arrowed dotted line from point 0 to point G, as permitted by today's laws). The true capital recovery toward point F must be the investor's goal (in an ideal environment without inflation).

**Fig. 11 (Part 1 of 2) Depreciation—Simulated Investment**



If the investor decides to accumulate capital toward point F in the contract time (*CT*) in the hope of recuperating his investment, he is in for a surprise: The tax law declares the amount from point G to point F as "profit (*P*) on which he has to pay taxes (*T*), providing him with a recuperated capital at point H. His recuperated capital reaches from point D to point H and he still has not recuperated the capital between point H and point F.

The investor will find that he has to accumulate capital in the contract time (*CT*) toward a tax-determined point I along the arrowed heavy line from point 0 to point I in order to recuperate his investment (*CI*) in full. If he accumulates capital toward point I, the amount between point G and point I will be declared as profit (*P*). From this "profit" he can now pay his taxes (*T*) and ends up at point F with fully recuperated investment, reaching from point D to point F and the amount from point F to point I are *taxes on unused investment* because of the time difference between the depreciation time (*DT*) and the contract time (*CT*). Point I determines for the contract time (*CT*) the time-dependent *simulated investment*—$SI_T$ toward which the investor has to accumulate capital in order to preserve the earning power of his investment in a non-inflationary economy.

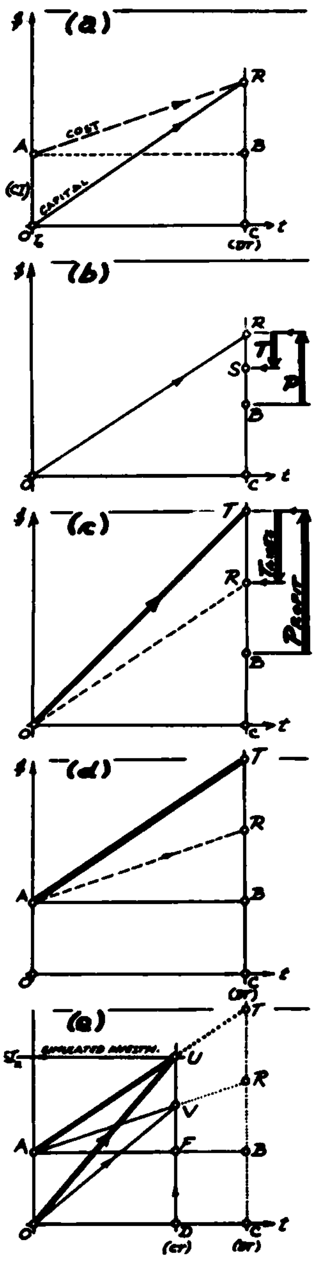
Now we can put a straight line (in our linearized model) through point I and point B. This line crosses the vertical $-axes of our coordinate system in point J and the line from point J to point B is the *geometrical location for all simulated time-dependent investments* between a contract time (*CT*) of zero and a contract time (*CT*) which equals the depreciation time (*DT*). For example, for the contract time (*CT*), equal to point L or point K on the time-axis (*t*), a simulated investment of SI, will result in point N and point M respectively.

**Fig. 11 (Part 2 of 2) Depreciation—Simulated Investment**

## Replacement Cost

Having made an investment and thereafter recuperating and accumulating capital toward the replacement cost of the investment is the monetary behaviour which coincides with the concept of the preservation of earning power. One of the most debated questions in accounting in the United States today is the tax-free capital accumulation toward the original investment or toward the replacement cost of such investment. However, since no decision is made, we have to concern ourselves with the present rule which determines that the difference between replacement cost and original investment must be covered out of profit. It should be noted that our foreign competitors can accumulate capital tax-free toward the replacement cost[35] which points toward the fact that, for example, the European tax philosophy, based on cost theory[36], defines profit quite differently than the American philosophy, which is based on price theory.

The American view toward replacement cost is outlined in the picture series of *fig. 12* and, as before in the discussion on depreciation time, we end up with the determination of a SIMULATED INVESTMENT FOR REPLACEMENT—$SI_R$.




At the time $T_0$ (*point 0*), an investment (*CI*) is made in the amount between point 0 and point A on the cost-axes (*$*) and after the depreciation time (*DT*) plotted on the time-axis (*t*); the replacement cost has increased to the amount between point C and point R. This means that the cost is increasing from point A to point R (if linearity of the increase is assumed) and as shown with the arrowed cost line between those two points. This, of course, means that the capital needed to replace the original investment should be accumulated along the arrowed capital line from point 0 toward point R and not toward point B, which corresponds with point A.

As before in the discussion of the depreciation time (*fig. 11f*), a capital accumulation toward the replacement value point R will not work for the investor because the amount between point B and point R will be declared as profit (*P*) from which the tax (*T*) must be paid, so that the investor arrives at point S, representing the accumulated after-tax capital between point C and point S. This means he is still short of the amount between point R and point S.

If the investor really wants to accumulate capital, he must select a tax-dependent point T toward which he accumulates capital and point T must be high enough above point R so that he can pay the taxes (*T*) on his profit (*P*) and still end up at point R, the replacement cost for his original investment. This means he has to pay *taxes on inflation*, because the increase in replacement cost *from point B to point* R is a function of inflation; everything else, like replacement quality, is considered as equal to the departure condition at the time ($T_0$) at point 0.

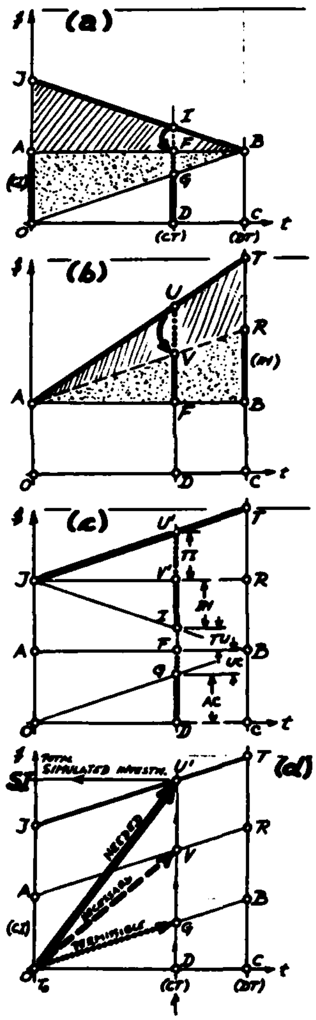
Having determined point T, representing the necessary accumulated capital in order to arrive at a net accumulation for the replacement cost at point R, we can now connect point T and point A with a straight line (because we are using linearized assumptions), and the line from point A to point T represents the geometrical *location for all simulated inflation-dependent investments* over the timeframe of the depreciation time (*DT*), represented by the distance between point 0 and point C.

If we now introduce the contract time (*CT*) at point D, then we are in a position to determine the necessary simulated investment for the contract time (*CT*) at the level $SI_t$. We are also able to determine the necessary capital accumulation along the arrowed heavy line from point 0 toward point U. Without tax on inflation, a capital accumulation along the arrowed broken line from point 0 toward point V would suffice.

**Fig. 12 Replacement—Simulated Investment**

## Depreciation Time and Replacement Cost

Having determined the simulated investment for the depreciation time (*fig. 11*) and for the replacement cost (*fig. 12*) we can now combine both considerations into a single behaviour pattern as shown in the picture series of *fig. 13:*



*SIMULATED INVESTMENT TIME*

This figure repeats the result of *fig. 11* and shows the line for the simulated investment from point B over point I to point J. In the contract time (*CT*) at point D we have accumulated tax-free the capital between point D to point G; we have paid taxes for non-utilisation, indicated by the distance from point F to point I; we have accumulated a total capital in the amount of the distance from point D to point I, paid tax on the "profit" from point G to point I and ended up with the capital at hand from point D to point F. *Result:* We have recuperated the investment (*CI*) in the contract time (*CT*) in full.

*SIMULATED INVESTMENT—INFLATION*

In the same way as we have shown the simulated investment for the timelag in *fig. 13a* above, we are showing here the simulated investment necessary to cope with inflation or to accumulate capital toward the replacement value. The simulated investment follows on the line from point A to point T and at the contract time (*CT*) at point D the total inflation amounts to the distance from point F to point V; however, to achieve the capital accumulation toward point V, capital must be accumulated toward point U in order to pay the tax (on "profit") in the amount of the distance from point V to point U.

*TOTAL SIMULATED INVESTMENT*

In order to combine the simulated investment for time and inflation, we put the triangle A-B-T from *fig. 13b* on top of the triangle O-B-J of *fig. 13a* and get the geometric *location for the total simulated investment* and the present figure shows the segments of the total simulated investment for the contract time (*CT*) at point D. The segments are: *first*, from point D to point G, *the tax-free accumulated capital (AC); second*, from point G to point F, the capital which cannot be recuperated in the contract time (*CT*) or the *unused capital (UC)* of the investment (*CI*); *third*, from point F to point I the *tax on unused capital (TU)* we have to pay on the "profit" (from point G to point I) in order to recuperate *de facto* capital toward the original investment (*CI*) at the contract time (*CT*) at point F; *fourth*, from point I to point V', the *inflation (IN)* which occurs from time-zero to the end of the contract time (*CT*) at point D, and *fifth*, from point V' to point U' the *tax on inflation (TI)* we have to pay in order to cover inflation.

*CAPITAL ACCUMULATION*

The three capital accumulations an investor has to consider are summarised in this figure: *first*, he has the tax-free *allowable capital accumulation* (or capital recovery for his investment) along the arrowed dotted line from point 0 to point G; *second*, he has the *necessary capital accumulation* along the arrowed broken line from point 0 to point V which represents his need to preserve the earning power of his investment, and *third*, he has the *needed capital accumulation* in order to achieve the necessary capital accumulation after paying taxes on his *de facto* costs which are presently declared as profit.

**Fig. 13 Total Simulated Investment**

# 5 THE MANAGEMENT DECISION: The Investment

The industry's sensitivity toward taxes and foremost toward the DEFINITION OF PROFIT is not always the same. In a time of explosive growth, of low interest rates and no disturbing inflation, no one will really care how profit is defined, especially if the market permits a large and comfortable profit margin. However, in times of market stabilisation without potential growth, in a time of high interest and rapid inflation, the sensitivity toward taxes will increase – especially concerning the definition of profit. When, in addition, the profit potential is minimised either through fierce competition or to an institutionalised profit cap[37], then the definition of profit becomes critical. And in such critical circumstances the first question an investor (or manufacturer) has to answer is how to produce – labor intensive or capital intensive? And the second (directly related) question will be how the decision on production methods influences the future value of the investment. The answer to both questions will determine the investment decision and we will address both questions in sequence.

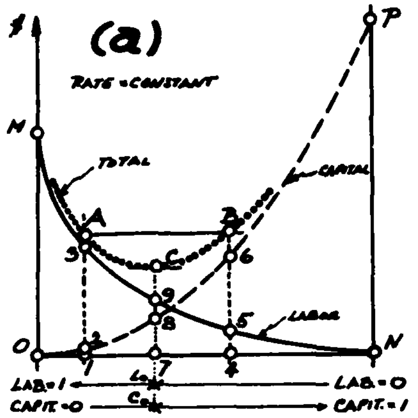
## Production Decision

In the commercial industry an investment in facilities for manufacturing is made upon two fundamental market forecasts: first upon the forecast of the production rate and second on the length of the production run. The risk of the investment is, of course, directly related to the quality of the forecast and the actual acceptance of the product by the market[38]. This "market risk" is reduced for major military acquisitions down to the timeframe of a specific contract and hence, the production rate (and often the production run) can be considered as a requirement. In turn, those requirements can be satisfied with many combinations of labor and capital allocation to the manufacturing process[39] as shown in *fig. 14*. Here, the conceptual presentation of the allocation problem is compared with (and translated into) the classical economic form of presentation[40].

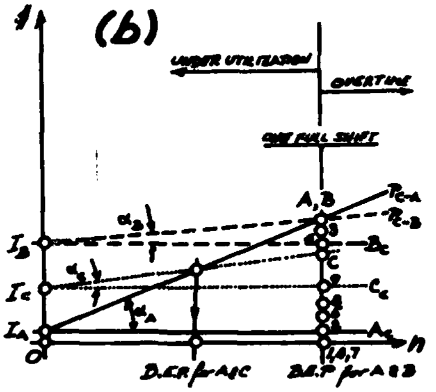
## Profit Cap

The cause for a profit limitation really does not matter (by law or under competitive pressure). Therefore we call any profit limitation superimposed to the manufacturer or contractor a profit cap. Now remember that in government contracts profit is defined as a percentage of all costs and the costs have two components: first the fixed cost for capital and second the variable or proportional cost for labor and material. For the present discussion we ignore material and assume that it might either be government-furnished or included in labor. This permits us to sketch the profit cap as shown in *fig. 15*.

Now let's return to the total simulated investment (*fig. 13*) and recall (from *fig. 13d*) that the profit plus the allowable capital recovery in the contract time must equate to the simulated investment. Hence, only this *de facto* capital investment (IC) can be justified, which satisfies this equation and, in turn, the justifiable labor elevation will follow by necessity. To calculate this process is an involved iterative search, working at the same time with many interdependent variables, with the high chance that only an approximate solution exists. This, however,



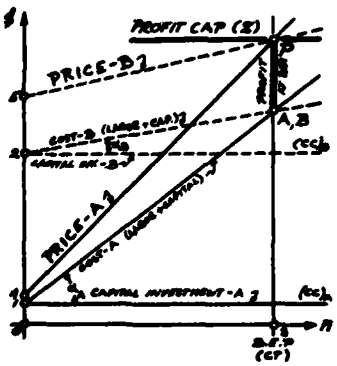

A given constant production rate can be achieved with a continuous changing combination of labor-*effort* and tooling- or capital-*effort*. Accordingly, the labor cost *will follow a Lorenz curve* from point M over point 3 and point 5 to point N, while the tooling cost will follow a Lorenz curve from point 0 over points 2, 8 and 6 to point P. The combination of both Lorenz curves will result in a total cost curve starting with point M and going through points A, C and B toward point P. The important considerations are: (1) *only one optimum exists*, point C with minimum cost for a giver production rate; (2) outside of the optimum, most cost levels can be achieved with two different labor/capital combinations as shown by point A and point B.




While the behaviour in *fig. 14a* has been portrayed in a close space, the present sketch uses an open space formed by the coordinates for cost ($) and the production quantity (*N*) and points A, B and C of *fig. 14a* now appear all on the break-even line with C at the lowest possible location and A and B in the same location. The important considerations are: (1) the optimal solution from *fig. 14a* is only valid for one single production rate—and *not* for a multiple of it as expressed by the N-axis, and (2) the identity of A and B is only related to the break-even point.

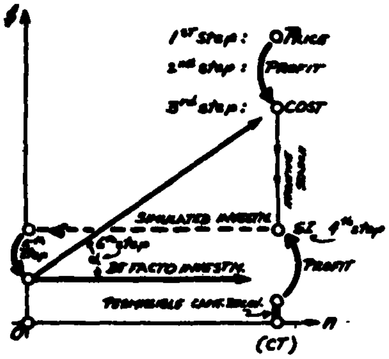
## Fig. 14 Labor and Capital Allocation

shall not be presently explained further; instead I will try to explain the process in a sketch in *fig. 16*. I hope this will suffice for the "understanding" of the concept. Also, please do not be disturbed that I start the explanation with price instead of cost.




We are carrying forward the two systems from *fig. 14b* and assume that both systems at the break-even point (*BEP*), point 3, result in the same cost, points A and B. We further assume that *the break-even point*, expressed in number of units (*N*) produced is reached at the end of the contract time (*CT*). Now we put a profit cap on top of the cost and arrive at the same price (*P*) for both systems A and B. With system A we have a low capital investment and a steep labor elevation—$a_A$ and for system B a high capital investment and a flat labor elevation—$a_B$.

## Fig. 15 Profit Cap




It is a valid assumption that a contractor searches first for the price where he thinks he can sell a specific product to the government. Therefore, we start the explanation with setting the price (*P*) as the first step. For the second step we deduct from the price the allowable or possible "profit" which leads us to the third step to the determination of the cost (*C*), which the manufacturer must achieve in order to be, within the (competitive) price, a successful bidder. Now, as the fourth step, he determines the simulated investment which he can accommodate with the recuperated capital (*CR*) plus the profit (*P*). For the fifth step, he searches for this *de facto* investment which he can make within the umbrella of the simulated investment. Having decided this, the necessary labor elevation, $\alpha$, follows as the sixth step.

**Fig. 16 The Investment Decision—"Present"**

## Present and Future

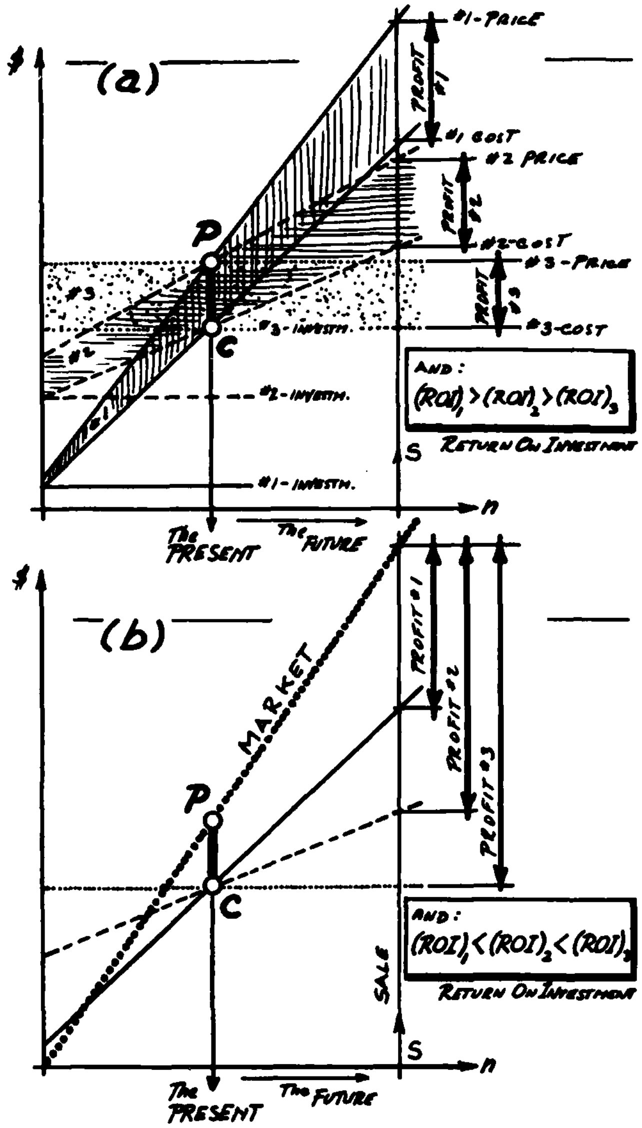
The decision process sketched in *fig. 16* covers only the present situation, where "present" shall be defined as the association with one definite contract at hand. Unfortunately, the decision which is correct for the "present" does not have to be correct for the "future," meaning for any timeframe going beyond the presently known contract time, and a good decision for today, may well be a bad decision for tomorrow. In order to explore this, let's make the possible (but unlikely) assumption that at "present" the same price and the same cost can be aligned with three different production methods: Method #1 would employ only the absolute minimum amount of capital investment and a maximum labor elevation; Method #2 would employ a fair capital investment and a moderate labor elevation, and Method #3 would employ a fully automated operation without any labor allocation. Of course, we assume for all three methods a predetermined profit cap on top of capital cost plus labor cost. The assumed three methods and the implications are sketched in *fig. 17*.

## Decision Trends

Although I worked (in *fig. 17*) only with the most fundamental economic tools, the decision trend for military acquisition and for commercial acquisition should be clear.

• *The investor for military acquisition*, presumably belonging to an industry in or close to Cluster #10 (the military/political industry) has no choice than to search for the ABSOLUTE MINIMUM INVESTMENT he can get by with. He has no other choice than to select the MOST LABOR-INTENSIVE operation he can afford and still be competitive against competitors who are all in the same predicament as he is.

• *The investor for commercial acquisition*, presumably belonging to an industry in or close to Cluster #1 (the commercial/common industry) will mostly search for the MAXIMUM INVESTMENT he can afford and for the MOST CAPITAL-INTENSIVE operation which he can blend with his risk assessment of the future in order to increase his profit potential.




*MILITARY ACQUISITION*

Between the three cost lines #1-C, #2-C, and #3-C (representing the three manufacturing methods), and the three price lines #1-P, #2-P and #3-P, *three profit bands* are formed: for Method #1 the band with vertical lines between two full lines, for Method #2 the band with the horizontal lines between two broken lines and for Method #3 between the two dotted lines and the dotted band. Notice that band #1 opens up considerably by moving into the future; band #2 opens up moderately by moving into the future and band #3 stays constant at the present end in the future.

*COMMERCIAL ACQUISITION*

In commercial acquisition no legal profit cap exists and we can assume a specific market will acquire the products. Again as before, we assume that all three methods result in the same cost (*C*) at the present, but that the market at present permits the same price (*P*) as in the case for military acquisition. If in the future a sale (*S*) can be generated, then the profit for the three methods of manufacturing will be different: the profit #1 for Method #1 will be the smallest and the profit #3 for Method #3 the largest.

**Fig. 17 Two Systems—Present & Future**

It is important to note that each decision process is based on two time references: first on the present "as is" and second about the investor's view of the future. The present time includes the belonging to a specific industrial cluster (Chapter 1), the existing environment conditions (Chapter 2) and the tax structure for investment (Chapter 4). The future time includes in the defence industry the expected contracts as the market surrogate, expected contract forms, change in the environmental conditions, possible competition and many other elements. Common to all those future elements, however, is the uncertainty which translates into risk and its corollary, the profit which must be measured against the baseline as established by the requirements for the preservation of earning power (Chapter 3).

Taking the "present" and the "future" simultaneously into account makes the decision process complex because of the existence of many opposing forces and because of many subtleties, neither calculable with standard methods[41], nor otherwise, because the probability of the future is undeterminable[42] and does not behave like the probabilities used in mechanistic problems in classical decision theory[43].

# GENERAL OBSERVATIONS: Suggestions

## 1. USA and Europe

First, in order to show how different tax laws can influence industrial behaviour, I compare the average defence industry in the United States and Europe[44] with regard to summary indicators. This is shown in *table V:*

| | Average For | |
|---|---|---|
| | *USA* | *Europe* |
| 1. Sales Per Company in $Million | 3,000 | 2,200 |
| 2. Assets Per Company in $Million | 1,200 | 2,500 |
| 3. Net Income Per Company in $Million | 110 | 37 |
| 4. Sales/Asset Ration | 2.5 | 0.9 |
| 5. Net Income as Percent of Sale | 3.6 | 1.7 |
| 6. Net Income as Percent of Assets | 9.0 | 1.5 |

NOTE: (Sales/Asset) x (% Income on Sale) = % Income on Asset

**Table V** Industrial Averages

The table shows clearly that in a place where all and any expenses can be called "cost" and where profit is used exclusively for growth, a relatively small profit (but true profit) will lead to a capital intensive operation.

## 2. Uniformity

It appears that something like a uniformity within the industrial base does not exist. I have suggested ten different clusters but any other clustering process – more detailed or less detailed – is absolutely possible. We do not know what a clustering of reality would be. However, it should be clear that no panacea *can* exist and, if forced upon the industrial base, must produce questionable results.

## 3. Labor and Capital

Before and even in the time of early industrialisation, all work was labor-intensive. Increase in agricultural productivity freed the labor force for rapidly growing industry, itself originally labor-intensive. This time, however, has long passed. Nevertheless, in past days the models for our accounting systems have been institutionalised and carried forward to the present, where we still associate profit on the sum of labor plus capital; also, return on capital takes its special place in the accounting system. Looking at today's reality, it appears that labor and

capital follow their own rules and hence should be separated in their considerations. I therefore suggest in-depth investigation into the practicality of changed contract procedures in the private and government arenas:

- *Separate* each contract into two distinct parts:
  - Part 1, the LABOR CONTRACT
  - Part 2, the CAPITAL CONTRACT
- Assign a RISK FACTOR to the labor portion of the contract.
- Assign a CAPITAL PRESERVATION FACTOR to the capital portion of the contract, provided this amount will be used to improve productivity at its source.
- Assign a PROFIT MARGIN to the total contract and make this portion of the profit tax-free, which is reinvested in the source for the purpose of growth.

(MATERIAL would be the third contract part. However, this is too involved to be included in the present paper. Reference 12 will deal with it in detail.)

## 4. Quantification

Industrial analysis is difficult because we seldom have the data we need (being mostly proprietary information). Nevertheless, attempts should be made to develop a database for the industrial base sector which permits an analytical validation of new approaches.

## 5. Systems Approach

I started this paper with a plea for LEGENOMY, the consideration of the inseparate *leg*al aspects, *en*gineering aspects and aspects of econ*omy*. I return to this plea. I am fully aware that we cannot separate the defense aspects from their political, social and economic environment. Hence simplistic solutions to complex problems will not exist. On the other hand, we have to conceptualise the complexity in order to deal with it. We have to understand the dynamic structure of our military products and we have to know Maxwell's demons inside the black box before we can give meaning and interpretation to statistical input-output models[45], the only developed tool we have at the moment. We have to search for tools which are appropriate to our reality of today instead of hiding behind yesterday's formalistics. We have to learn to respect all disciplines and have to learn how to cooperate. More specifically, the subject I have addressed is not for engineers alone to solve, not for lawyers and not for economists. Only working together will bring success. We have to learn to think interdisciplinarily—and even teach it as a new subject; applied operation research might be the first step in this direction.

## 6. Return to Technology

I agree completely with the statement that "we stand upon a threshold of a bright future as new production technologies become available and are implemented... [It] will be a positive

step in the program of reindustrialising American industry by introducing smarter machines and making our factories more productive."[46] But technology—and this is my contention—cannot grow, flourish and be effective as long as the environment does not permit it to be fully utilised. The economic clime is the prerequisite for the effectiveness of technology. Of course, how we prepare it may be a political rather than a "scientific" question. Scientific analysis can duly bound the problem by sketching the three extreme options as outlined in *fig. 18.* This figure uses the two extreme Clusters #1 and #10 (see Chapter 1) which is the pure commercial/common cluster of industries and the military/political cluster. One extreme option exists for the first cluster and two for the second.

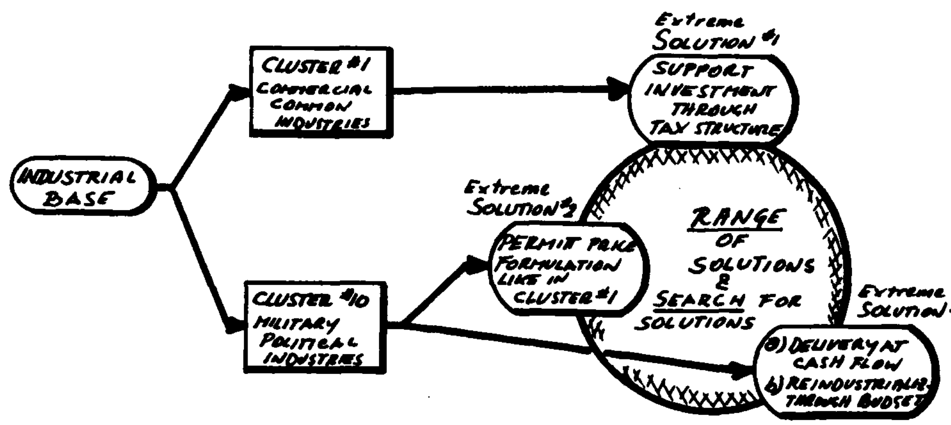



**Fig. 18** Toward Re-Industrialisation

Not much has to be said about Solution #1, however, Solutions #2 and #3 are of interest for military acquisition: In Solution #2 we are handling the industrial base exactly like a private industry, where it must be the industries' responsibility to rejuvenate themselves by permitting a price formulation which can accomplish this. In Solution #3, however, we are taking the entire responsibility for rejuvenation out of the industry and putting the burden on the budget side of the Federal government. In this case we would pay in real time for the cashflow (or pocket cost) only and postpone respectively shifting the burden for reindustrialisation to the government. Unfortunately, the differences between Solutions #2 and #3 are more cosmetic than real; the difference is rather the preference for how to pay the bill which ultimately must be paid anyhow.

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